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(54) Title: DATA RECORDING MEDIUM AND DATA RECORDING DEVICE

(57) Abstract

Problem

There are cases where a control code is divided across multiple packets due to packetization, or a data sequence identical to that of a control code is generated when an added header and a part of data were combined, resulting in problems of complicating the stream analysis technique and increasing the processing time.

Means to solve

When generating packets from a stream based on a prescribed packetization method, whether any control code will be divided across multiple packets and whether a data sequence identical to that of the control code will be generated are determined; whereby, if the aforementioned determination result indicates that such event will occur, data blocks are generated and packetized after the applicable stream dividing position is shifted.

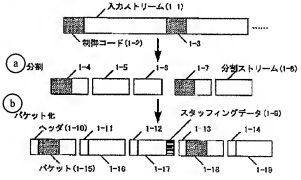

Figure 1

Key:
- a Division
- b Packetization
- 1-1 Input stream
- 1-2 Control code
- 1-8 Segment stream
- 1-9 Stuffing data
- 1-10 Header
- 1-15 Packet

Claims

1. A data recording medium on which a discrete data sequence (referred to as a stream, hereinafter) is recorded, characterized by recording packets that are each configured with a header and a data block containing an input stream of a fixed length that is defined according to prescribed rules; wherein, in a stream generated by connecting the input stream containing the data block of a certain packet with the input stream containing the immediately following packet, a part of a control code is present at the position located at the length defined by the aforementioned prescribed rules after the beginning of the aforementioned connected stream, and stuffing data are inserted in the data block of the aforementioned packet.

2. A data recording medium on which a stream is recorded, characterized by recording packets that are each configured with a header and a data block containing an input stream of a fixed length that is defined according to prescribed rules; wherein, in a stream generated by connecting the input stream containing the data block of a certain packet with the input stream containing the immediately following packet, a data sequence present at the position located at the length defined by the aforementioned prescribed rules after the beginning of the aforementioned connected stream is a data sequence that becomes identical to the sequence of a prescribed control code when combined with a part of the packet header, and stuffing data are inserted in the data block of the aforementioned packet.

3. The data recording medium described in Claims 1 and 2, characterized in that the aforementioned prescribed rules refers to rules for fixing the data block length of the individual packets or the packet length with respect to each packet type or all packets.

4. The data recording medium described in Claims 1 and 2, characterized in that the aforementioned prescribed control code refers to a start code that indicates the position where information starts within the stream or an end code that indicates the position where information ends within the stream and an accompanying data sequence.

5. A computer-readable recording medium characterized by having a data packetization method, by which a stream is divided into multiple data blocks and packetized by adding a header to each data block, where the data packetization method involves a first step in which the stream is packetized based on the prescribed packetization method, a second step in which it is determined whether any prescribed control code contained in the stream is divided across multiple packets as a result of the aforementioned first step, a third step in which data blocks containing the aforementioned control codes that are completed within the data blocks are generated based on the aforementioned determination result, and a fourth step in which the aforementioned data blocks are packetized based on the aforementioned prescribed packetization method.

6. A computer-readable recording medium characterized by having a data packetization method, by which a stream is divided into multiple data blocks and packetized by adding a header to each data block, is recorded, where the data packetization method involves a fifth step in which the stream is packetized based on the prescribed packetization method, a sixth step in which it is determined whether a data sequence comprising partial data in the stream and a part of the added header becomes a data sequence identical to a prescribed control code as a result of the aforementioned fifth step, a seventh step in which data blocks that do not generate any identical data sequence are generated based on the aforementioned determination result, and an eighth step in which the aforementioned data blocks are packetized based on the aforementioned packetization method.

7. The computer-readable recording medium described in Claims 5 and 6, characterized in that the aforementioned packetization method refers to a packetization method for achieving a fixed data block length or a packet length, a method for dividing and packetizing the stream based on a prescribed timer interval, or a method that combines the above.

8. The computer-readable recording medium described under Claim 5, characterized in that, in the aforementioned method for determining whether any prescribed control code contained in the aforementioned stream is divided across multiple packets, a decision is made based on whether any prescribed control code is present at a position where the stream is divided using the aforementioned dividing method when dividing the stream using the aforementioned prescribed packetization method.

9. The computer-readable recording medium described in Claim 5, characterized in that, in the aforementioned method for generating data blocks containing control codes that are completed within the data blocks, it is determined whether any prescribed control code is divided across multiple packets; whereby, when a decision is made that splitting will occur, the applicable stream dividing position is moved to a position either before or after said control code when dividing the stream, and stuffing data are then inserted into the data block to be generated; when a decision is made that no splitting will occur, the data blocks are generated in accordance with the aforementioned prescribed packetization method.

10. The computer-readable recording medium described in Claim 6, characterized in that, in the aforementioned method for determining whether a data sequence comprising partial data in the stream and a part of the added header becomes a data sequence identical to a prescribed control code, a decision is made based on whether a data sequence that comprises parts of data that are present before and after a position where the stream is divided using the aforementioned dividing method when dividing the stream using the aforementioned prescribed packetization method becomes identical to the sequence of a prescribed control code.

11. The computer-readable recording medium described in Claim 6, characterized in that the aforementioned method for generating data block that do not generate the aforementioned identical data sequence refers to a method in which, when a decision is made that an identical data sequence will be generated as a result of the use of the method for determining whether the aforementioned data sequence is generated, after having moved the position where the stream is divided to a position before or after the part of the data in the aforementioned stream, and stuffing data are inserted to generate a data block; when a determination is made that no identical data sequence will be generated, the data blocks are generated in accordance with the aforementioned prescribed packetization method.

12. The computer-readable recording medium described in one of Claims 5, 6, and 10, characterized in that the aforementioned prescribed control code refers to a start code that indicates the position where information starts within the stream or an end code that indicates the position where information ends within the stream and an accompanying data sequence.

13. A data recording device that divides a stream into multiple data blocks, adds a header to each of the data blocks to generate packets, and stores them, characterized by comprising a first means that takes a stream as an input and outputs positions where the stream should be divided when dividing the stream based on a prescribed packetization method; a second means that takes the aforementioned dividing positions and the stream as input and outputs a determination result regarding whether any prescribed control code contained in the stream will be divided as a result of the use of the aforementioned prescribed packetization method; a third means that takes the aforementioned determination result and the stream as input and outputs positions where the stream should be divided for the aforementioned prescribed control codes to be completed within data blocks; a fourth means that takes the aforementioned dividing positions and the stream as input and outputs segment streams; a fifth means that takes the aforementioned segment streams as input and output data blocks after having inserted stuffing data; a sixth means that takes the aforementioned data blocks as input, packetizes them by adding a header to them, and outputs them.

14. A data recording device that divides a stream into multiple data blocks, adds a header to each of the data blocks to generate packets, and stores them, characterized by comprising a seventh means that takes a stream as input and outputs positions where the stream should be divided when dividing the stream based on a prescribed packetization method; an eighth means that takes the aforementioned dividing positions and the stream as input and outputs a determination result regarding whether a data sequence that comprises a part of data within a data block and a part of the added header becomes a data sequence identical to that of the aforementioned prescribed control code as a result of the use of the aforementioned prescribed packetization method; a ninth means that takes the aforementioned determination result and the

stream as input and outputs positions where the stream should be divided for a data sequence identical to the aforementioned prescribed control code not to be generated; a tenth means that takes the aforementioned dividing positions and the stream as input and outputs segment streams; an eleventh means that takes the aforementioned segment streams as input and outputs data blocks after having inserted stuffing data; a twelfth means that takes the aforementioned data blocks as input, packetizes them by adding a header to them, and outputs them.

Detailed description of the invention

[0001]

Technical field of the invention

The present invention pertains to a data recording medium for storing a stream in the form of packets, a computer-readable recording medium on which a data packetization method is recorded, and a data recording device. In particular, it pertains to a data medium for recording MPEG-based multimedia data, a computer-readable recording medium on which a data packetization method is recorded, and a data recording device.

[0002]

Prior art

The encoding system MPEG (Moving Picture Experts Group) was established as a method for digitizing, recording, and transmitting a large amount of video and audio information. It has become an international standard encoding system and implemented as standards ISO/IEC 11172 and ISO/IEC 13818. These systems are adopted as encoding methods for digital satellite broadcasting and DVDs. They are now utilized for even a wider range of applications and have become more accessible.

[0003]

In addition, there are increasing demands for processing of digitally recorded video and audio due to the development of digital video cameras and large-capacity recording media such as DVD-RAM and DVD-RW, and high-speed retrieval and analysis of such data are also researched and developed vigorously accordingly.

[0004]

The MPEG system will be exemplified in the explanation given below. The ISO/IEC 13818 standard (referred to as the MPEG-2 standard, hereinafter) comprises the ISO/IEC 13818-1 standard (referred to as system standard the hereinafter), the ISO/IEC 13818-2 standard (referred to as video standard, hereinafter), and ISO/IEC 13818-3 standard (referred to as audio

standard, hereinafter); streams of the video standard and the audio standard are multiplexed using the system standard. In the video standard and the audio standard, pieces of video and audio information are structured according to an encoding unit, and the pieces of information are detected using a specific start code or sync data. Also, in the system standard, not only video and the audio information, but also information regarding encoder parameters and data arrangement on a storage medium can be multiplexed.

[0005]

In the system standard, when multiplexing these data streams for transmission or recording, the respective stream in conformity with the video standard and the audio standard are divided into an appropriate length and a header is added for packetization; the multiplexing is applied by packet unit. The packet comprises a header part and a payload part, and information for video-audio synchronization and a flag indicating data characteristics are recorded in the header part. The video/audio data stream is recorded in the payload part.

[0006]

When the streams are divided into packets of a specific length, the data can be recorded, transmitted, and played back efficiently. Especially, when such a storage medium as a DVD or a CD is utilized, the length of a sector that is, the unit of recording, is predetermined; data are recorded on a DVD in pack units of 2,048-byte length as shown in Institute of Image Information and Television Engineers Journal Vol. 51, No. 7, pp. 942-946 (1997). In addition, as shown in the MPEG-2 standard, a TS packet of a fixed length is used for the transport stream (TS) utilized for satellite broadcasting.

[0007]

Problems to be solved by the invention

While the streams can be multiplexed efficiently by means of packetization, if a stream is divided into a prescribed length for packetization, a start code and a sync data sequence may in some cases end up being divided and recorded across multiple packets. In this case, the start code of the stream cannot be detected by simply checking the payload part of the packet individually, resulting in problems that the detection and analysis techniques become complicated, and the processing time is increased.

[0008]

Recording of data on a DVD may be mentioned as an example of packetization involving fixed packet length. As described above, in the case of a DVD, data are recorded in units of

2,048 bytes. The TS packet of a fixed length also is used for the packetization of the transport stream introduced in MPEG-2 system standard. Since the pack and the TS packet are both configured with a header part and a data block part, and it is possible that such a control code as a start code contained in the data block part may end up being divided and recorded across multiple packs or packets.

[0009]

An example will be explained with reference to Figure 2. Here, a packetization method for attaining a fixed packet length will be exemplified. After input stream 2-1 is divided into segment streams 2-4, 2-5, 2-6, 2-7, and 2-8, the aforementioned segment streams are treated as data blocks and headers 2-11, 2-12, 2-13, 2-14, and 2-15 are added to generate packets 2-16, 2-17, 2-18, 2-19, and 2-20. When the headers have a fixed length, the packets can have a fixed length if the segment streams have a fixed length. At this time, however, a control code (2-3 in this case) contained in the stream ends up being divided into split control codes 2-9 and 2-10, resulting in a possibility that the control code cannot be detected in the packet unit. For example, assuming that sequence header 0x000001B3 of the MPEG-2 standard is a control code contained in the stream, and this code is split at the center, the first half portion 0x0000 is contained in the data block of the preceding packet, and the second half portion 0x01B3 is contained in the data block of the following packet. That is, the control code is divided, and the aforementioned control code cannot be detected when analyzed by packet unit.

[0010]

As described in the MPEG-2 system standard, another problem is that a data sequence that is identical to that of a start code defined by the video standard may be generated at the boundary between the header part added in accordance with the system standard and the payload part during the packetization. This data sequence is called a pseudo-start code. The pseudo-start code becomes a factor responsible for false detection of a start code from a packetized data sequence.

[0011]

An example will be explained with reference to Figure 3. In the figure, a packetization method for attaining a fixed packet length will be exemplified. After input stream 3-1 is divided into segment streams 3-5, 3-6, 3-7, 3-8, and 3-9, the aforementioned segment streams are treated as data blocks and provided with headers 3-11, 3-12, 3-13, 3-14, and 3-15 to generate packets 3-16, 3-17, 3-18, 3-19, and 3-20. The input stream contains prescribed control codes 3-2, 3-3, etc.

[0012]

When the headers have a fixed length, the packets can have a fixed length if the segment streams have a fixed length. At this time, however, if the specific data sequence 3-4 is present in the stream, data sequence 3-10 that is identical to a prescribed control code, is generated as it is combined with a part of added header 3-14, resulting in the possibility or a false detection of a start code.

[0013]

For example, when a stream in conformity with the MPEG-2 video standard is packetized in accordance with the MPEG-2 system standard, if specific data sequence 0x000001 is present at the end of a data block, it is combined with starting data sequence 0x000001E0 in the header of the next packet. As a result, picture start code 0x00000100 of the MPEG-2 video standard that is supposed to be detected only within a data block appears at the packet boundary. Although the occurrence of the pseudo-start code can be prevented by generating the data blocks by the unit of a picture by changing the data block length, this technique cannot be utilized when the packet length is fixed.

[0014]

Because the primary purpose of the conventional packetization processing in conformity with the MPEG-2 standard is to multiplex streams, contents of the data inside the payload parts are not checked. The aforementioned problems arise as a result. However, it is preferable to generate packetized data that do not contain any split control code and pseudo-start code from the beginning to allow packetized streams to be analyzed and edited using a simple means.

[0015]

Accordingly, the purpose of the present invention is to provide a data packetization method and a data packetization device that are used to generate encoded data sequences that can be analyzed easily; wherein, problems attributable to a packetization method, for example, a case where such a control code as a start code in a stream is divided across multiple packets as a result of packetization and a case where a pseudo-start code is generated, are predicted in advance; packetization is carried out while preventing said phenomena.

[0016]

Means to solve the problems

To achieve the aforementioned purpose, as the data recording medium of the present invention for recording a stream, a data recording medium for recording packets that are each

configured with a header and a data block containing an input stream while the length is fixed according to prescribed rules, is utilized; wherein, in a stream generated by connecting the input stream containing the data block of a certain packet with the input stream containing the immediately following packet, a part of a control code is present at the position located at the length defined by the aforementioned prescribed rules after the beginning of the aforementioned connected stream, and stuffing data are inserted in the data block of the aforementioned packet.

[0017]

In addition, as the data recording medium of the present invention for recording a stream, a data recording medium for recording packets that are each configured with a header and a data block containing an input stream of a fixed length that is defined according to prescribed rules, is utilized; wherein, in a stream generated by connecting the input stream containing the data block of a certain packet with the input stream contained in the immediately following packet, a data sequence that is present at the position located at the length defined by the aforementioned prescribed rules after the beginning of the aforementioned connected stream is a data sequence that becomes identical to the sequence of a prescribed control code when combined with a part of the packet header, and stuffing data are inserted in the data block of the aforementioned packet.

[0018]

The aforementioned prescribed rules refers to rules for fixing the data block length of the individual packets or the packet length with respect to each packet type or all packets.

[0019]

Here, the aforementioned prescribed control code refers to a start code that indicates the position where information starts within the stream or an end code that indicates the position where information ends within the stream and an accompanying data sequence.

[0020]

As a computer-readable recording medium for recording a data packetization method by which a stream is divided into multiple data blocks and packetized by adding a header to each data block, a computer-readable recording medium is used that contains a data packetization method involving a first step in which the stream is packetized based on the prescribed packetization method, a second step in which it is determined whether any prescribed control code contained in the stream is divided across multiple packets as a result of the aforementioned first step, a third step in which data blocks containing the aforementioned control codes that are

completed within the data blocks are generated based on the aforementioned determination result, and a fourth step in which the aforementioned data blocks are packetized based on the aforementioned prescribed packetization method.

[0021]

As a computer-readable recording medium on which a data packetization method, by which a stream is divided into multiple data blocks and packetized by adding a header to each data block, is recorded, a computer-readable recording medium is used that contains a data packetization method that involves a fifth step in which the stream is packetized based on the prescribed packetization method, a sixth step in which it is determined whether a data sequence comprising partial data in the stream and a part of the added header becomes a data sequence identical to a prescribed control code as a result of the aforementioned fifth step, a seventh step in which data blocks that do not generate any identical data sequence are generated based on the aforementioned determination result, and an eighth step in which the aforementioned data locks are packetized based on the aforementioned packetization method.

[0022]

The aforementioned packetization method refers to a packetization method for achieving a fixed data block length or a packet length, a method for dividing and packetizing the stream based on a prescribed timer interval, or a method that combines the above.

[0023]

The aforementioned method for determining whether any prescribed control code contained in the aforementioned stream is divided across multiple packets refers to a method in which the determination is made based on whether any prescribed control code is present at a position where the stream is divided using the aforementioned dividing method when dividing the stream using the aforementioned prescribed packetization method.

[0024]

The aforementioned method for generating the data blocks containing the control codes that are completed within the data blocks refers to a method in which it is determined whether any prescribed control code is divided across multiple packets; whereby, when a determination is made that splitting will occur, the applicable stream dividing position is moved to a position either before or after said control code when dividing the stream, stuffing data are then inserted to generate a data block; when a determination is made that no splitting will occur, the data blocks are generated in accordance with the aforementioned prescribed packetization method.

[0025]

The aforementioned method for determining whether a data sequence comprising partial data in the stream and a part of the added header becomes a data sequence identical to a prescribed control code refers to a method in which a determination is made based on whether a data sequence that comprises parts of data that are present before and after a position where the stream is divided using the aforementioned dividing method when dividing the stream using the aforementioned prescribed packetization method becomes identical to the sequence of a prescribed control code.

[0026]

The aforementioned method for generating data block that do not generate the aforementioned identical data sequence refers to a method in which when a determination is made that an identical data sequence will be generated as a result of the use of the method for determining whether the aforementioned data sequence is generated, after having moved the position where the stream is divided to a position before or after the part of the data in the aforementioned stream, stuffing data are inserted; when a determination is made that no identical data sequence will be generated, the data blocks are generated in accordance with the aforementioned prescribed packetization method.

[0027]

The aforementioned prescribed control code refers to a start code that indicates the position where information starts within the stream or an end code that indicates the position where information ends within the stream and an accompanying data sequence.

[0028]

As a data recording device that divides a stream into multiple data blocks, adds a header to each of the data blocks to generate packets, and stores them, a data recording device is used that comprises a means that takes a stream as input and outputs positions where the stream should be divided when dividing the stream based on a prescribed packetization method; a means that takes the aforementioned dividing positions and the stream as input and outputs a determination result regarding whether any prescribed control code contained in the stream will be divided as a result of the use of the aforementioned prescribed packetization method; a means that takes the aforementioned determination result and the stream as input and outputs positions where the stream should be divided for the aforementioned prescribed control codes to be completed within data blocks; a means that takes the aforementioned dividing positions and the

stream as input and outputs segment streams; a means that takes the aforementioned segment streams as input and outputs data blocks after having inserted stuffing data; a means that takes the aforementioned data blocks as input, packetizes them by adding a header to them, and outputs them.

[0029]

As a data recording device that divides a stream into multiple data blocks, adds a header to each of the data blocks to generate packets, and stores them, a data recording device is used that comprises a means that takes a stream as input and outputs positions where the stream should be divided when dividing the stream based on a prescribed packetization method; a means that takes the aforementioned dividing positions and the stream as input and outputs a determination result regarding whether a data sequence that comprises a part of data within a data block and a part of the added header becomes a data sequence identical to that of the aforementioned prescribed control code as a result of the use of the aforementioned prescribed packetization method; a means that takes the aforementioned determination result and the stream as input and outputs positions where the stream should be divided for a data sequence identical to the aforementioned prescribed control code not to be generated; a means that takes the aforementioned dividing positions and the stream as input and outputs segment streams; a means that takes the aforementioned segment streams as input and outputs data blocks after having inserted stuffing data; a means that takes the aforementioned data blocks as input, packetizes them by adding a header to them, and outputs them.

[0030]

Embodiment of the invention

An application example of the packetized data generated in accordance with the present invention is shown in Figure 1, and said generation method will be described.

[0031]

In the figure, as a packet configured with a header and a data block whose length is defined according to prescribed rules, a stream with a fixed packet length will be exemplified. The data block whose length is defined according to prescribed rules will be described later.

[0032]

First, input stream 1-1 is divided into segment streams 1-4, 1-5, 1-6, 1-7, and 1-8. At this time, the stream is divided in such a manner that neither control code 1-2 nor 1-3 is split. Since it is possible that a control code may be split if the dividing positions are decided with the segment

streams length fixed, when a dividing position coincide with a control code, the dividing position is shifted to a position before the control code. Stuffing data 1-9 are inserted into the aforementioned segment streams as needed; headers 1-10, 1-11, 1-12, 1-13, and 1-14 are provided to data blocks to generate packets 1-15, 1-16, 1-17, 1-18, and 1-19.

[0033]

For example, video/audio elementary stream ES in conformity with the MPEG-2 standard may be mentioned as the input stream. When packetization is applied in conformity with the transport stream TS described in the MPEG-2 system standard, packetized elementary stream PES may be input. Pack, packet, and TS packet of the MPEG-2 standard may be mentioned as examples of the packet. For example, the header includes a packet header and a pack header of the MPEG-2 standard.

[0034]

Contents of the MPEG-2 header are described in the ISO/IEC 13818 specification. The stuffing data include a padding packet also. The padding packet has the 0x000001BE start code of the MPEG-2 standard. A common technology, such as the MPEG-2 system standard, may be applied directly in terms of the contents of the stuffing data and the padding packet. The stuffing data and the padding packet may be omitted. As a result, data can be generated without splitting the prescribed control codes in the stream across multiple packets.

[0035]

This kind of stream, in which the control codes are not split across multiple packets, shows the following characteristic when recorded on the data recording medium. That is, in the case of the stream comprising the packets with the fixed length as exemplified here, when a stream generated by connecting the input stream contained in a certain packet with the input stream contained in the immediately following packet is fetched, a part of a control code is present at the position located at the length defined by the aforementioned prescribed rules after the beginning of the aforementioned connected stream.

[0036]

When the input streams are fetched from packets 1-17 and 1-18, a stream is generated by connecting 1-6 with 1-7. Control code 1-3 is present at the position located at the length of the data block from the beginning of this connected stream. This data structure is formed when the stuffing data are inserted to prevent the control code from being split. When the control codes

are not split across multiple packets in the data, the control codes can be detected by inspecting the packets individually. The prescribed control codes will be described later.

[0037]

Another application example of the packetized data generated in the present invention is shown in Figure 4, and the generation method will be explained below.

[0038]

As the packet configured with the header and the data block whose length is defined according to the prescribed rules, a stream with a fixed packet length will be exemplified. The data block whose length is defined according to the prescribed rules will be described later.

[0039]

First, input stream 4-1 is divided into segment streams 4-5, 4-6, 4-7, 4-8, and 4-9. The input stream contains control codes 4-2 and 4-3. At this time, if specific data sequence 4-4 that becomes a data sequence identical to a prescribed control code when combined with a part of the header added is present, the stream is divided in such a manner that no data sequence identical to that of the aforementioned control code will be generated. It is possible that the stream may be divided immediately after the aforementioned specific data sequence if the dividing positions are decided while using a fixed length for the segment streams. In such case, the dividing position is shifted.

[0040]

Stuffing data 4-10 are inserted into the aforementioned segment streams as needed; headers 4-11, 4-12, 4-13, 4-14, and 4-15 are provided to the data blocks to generate packets 4-16, 4-17, 4-18, 4-19, and 4-20. The input stream, the packets, the headers, and the stuffing data are already described above. As a result, data without a data sequence comprising partial data in the stream and a part of the added header become a data sequence identical to any prescribed control code can be generated.

[0041]

This kind of stream that contains no data sequence identical to any control code shows the following characteristic when recorded on the data recording medium. That is, in the case of the stream comprising the packets with the fixed length as exemplified here, when a stream generated by connecting the input stream contained in a certain packet with the input stream contained in the immediately following packet is fetched, a part of a specific data sequence that

becomes a data sequence identical to that of a control code is present at the position located at the length defined by the aforementioned prescribed rules after the beginning of the aforementioned connected stream.

[0042]

When the input streams are fetched from packets 4-18 and 4-19, a stream is generated by connecting 4-7 with 4-8. Specific data sequence 4-4 is present at the position located at the length of the data block from the beginning of this connected stream. This data structure is formed when the stuffing data are inserted to prevent the occurrence of such identical data sequence.

[0043]

Next, the packet configured with the header and the data block whose length is defined according to the aforementioned prescribed rules will be described.

[0044]

An example configuration of the packet is shown in Figure 5. In general, packets 5-1 and 5-2 comprise headers 5-3 and 5-4 that include stream synchronization information and flags indicating stream characteristics and data blocks 5-5 and 5-6 that contain stream data. Also, there are cases where a packet packetized using a different method is contained within a data block. Packet types are identified by the headers.

[0045]

For example, in the case of the MPEG-2 standard, a video packet has a header that begins with 0x000001E0, and an audio packet has a header that begins with 0x000001C0. The packet and the header are already described above. Here, as a packet comprising a header and a data block whose length is defined according to prescribed rules, a packet with a fixed data block length or a fixed packet length are feasible. These rules may be applied to packets of a specific single type, they may be applied to multiple types, or they may be applied to all packets.

[0046]

As an example involving a fixed packet length, as shown in Institute of Image Information and Television Engineers Journal Vol. 51, No. 7, pp. 942-946 (1997), there is a stipulation that data should be recorded in units of 2,048-byte length in the case of DVD. A TS packet with a fixed length is used in the case of the transport stream (TS) of the MPEG-2 system standard utilized for satellite broadcasting.

[0047]

Next, the aforementioned prescribed control code will be explained.

[0048]

An example configuration of the control code is shown in Figure 6. Packet 6-1 comprises header 6-2 and data block 6-3. The data block is configured with a stream. Control code 6-4 is present inside the stream. The control code comprises start code 6-5 that indicates where information begins in the stream, or an end code that indicates sync data and where information ends in the stream, and accompanying data sequence 6-6. For example, in the case of the MPEG-2 standard, a sequence header, a picture header, an audio access unit header, an audio frame, and audio sampling data are treated as control codes. The sequence header begins with sequence start code 0x000001B3 and has an accompanying data sequence indicating bit rate information, for example. The picture header begins with picture start code 0x00000100 and has an accompanying data sequence indicating a picture type, for example. The audio access unit header begins with sync data 0xFFF and has an accompanying data sequence indicating a layer, for example. These accompanying data may be omitted. The length of the control code may be matched with the data length to be detected by the unit of a packet. Control codes of the MPEG-2 standard are described in the ISO/IEC 13818 standard.

[0049]

An application example of a system configuration for implementing the data packetization method that utilizes the computer-readable recording medium of the present invention is shown in Figure 7. As computer 7-1 reads computer-readable recording medium 7-2 to load a program into a memory, the computer begins to execute the data packetization. Internal configuration 7-3 of the computer is shown. The program is loaded into program memory 7-5. Arithmetic unit 7-4 reads this program; whereby, it generates packets from an input stream fetched into input buffer 7-6, transfers them to output buffer 7-7, and outputs the packetized data from the output buffer. These memories are merely classified according to their functions, and they may be configured on the same memory.

[0050]

An application example of the method for packetizing the data to be recorded on the computer-readable recording medium in the present invention is shown in Figure 8, and said method will be explained below.

[0051]

In the figure, the operation begins at Step 8-1. In Step 8-2, the positions where the input stream should be divided are decided based on the prescribed packetization method, and advancement is made to Step 8-3. The input stream is already described above. The prescribed packetization method will be described later.

[0052]

In Step 8-3, it is determined whether any prescribed control code will be split across multiple packets based on the stream dividing position information obtained in Step 8-2, and advancement is made to Step 8-4. Details of the determination method and the prescribed control code will be described later.

[0053]

In Step 8-4, data blocks, wherein control codes are competed within respective data blocks, are generated based on the result of the determination made in Step 8-3; advancement is made to Step 8-5. The method for generating the data blocks, wherein control codes are competed within respective data blocks, will be described later.

[0054]

In Step 8-5, headers are added to the data blocks generated in Step 8-4 to generate packets. The packet and the header are already described above. In Step 8-6, data packetization is ended. The data packetization is carried out through the aforementioned steps.

[0055]

Another application example of the method for generating the data packets recorded on the computer-readable recording medium in the present invention is shown in Figure 9.

[0056]

In the figure, the operation begins at Step 9-1. In Step 9-2, the positions where the input stream should be divided are decided based on the prescribed packetization method; advancement is made to Step 9-3. The input stream is already described above. This Step 9-2 is identical to Step 8-2.

[0057]

In Step 9-3, it is determined whether any data sequence comprising partial data of the stream and a part of a header will become identical to that of any control code based on the

stream dividing position information obtained in Step 9-2, and advancement is made to Step 9-4. Details of the determination method will be explained later.

[0058]

In Step 9-4, data blocks that contain no data sequence identical to that of any control code are generated based on the result of the determination made in Step 9-3, and advancement is made Step 9-5. The method for generating the data blocks containing no data sequence identical to that of any control code will be described later.

[0059]

In Step 9-5, headers are added to the data blocks generated in Step 9-4 to generate packets. The packet and the header are already described above. This step is identical to Step 8-5. In Step 9-6, data packetization is ended. The packetization is carried out through the aforementioned steps.

[0060]

Next, the aforementioned prescribed packetization method will be described.

[0061]

It will be explained using the example packet configuration shown in Figure 5. In general, packets 5-1 and 5-2 comprise headers 5-3 and 5-4 that include stream synchronization information and flags indicating stream characteristics and data blocks 5-5 and 5-6 that contain stream data. The data block and the packet are already described above. The packetization is achieved by dividing a stream into data blocks and adding headers to them. Here, a method in which a fixed data block length or a fixed packet length is used for packetization, a method in which a stream is divided based on a prescribed timer interval for packetization, or a method that combines them are feasible as the prescribed packetization method.

[0062]

For example, in the case of the method in which a fixed length is used for the data blocks during the packetization, the packets are generated by dividing the stream into data blocks of the prescribed length and adding headers to them. As an example involving a fixed packet length, as shown in Institute of Image Information and Television Engineers Journal Vol. 51, No. 7, pp. 942-946 (1997), there is a stipulation that data should be recorded in units of 2,048-byte length in the case of DVD. A TS packet with a fixed length is used in the case of the transport stream

(TS) of the MPEG-2 system standard utilized for satellite broadcasting; wherein, packets of a fixed length are generated through the packetization.

[0063]

The method for determining whether any prescribed control code is split across multiple packets is shown in Figure 10. Here, details of Step 8-3 are shown.

[0064]

First, in the figure, the operation begins at Step 10-1. The positions where the stream should be divided are decided based on the aforementioned prescribed packetization method, and advancement is made to Step 10-2. For example, when a method involving a fixed packet length is used as the prescribed packetization method, the distance of the dividing position from the beginning position of the stream is obtained by subtracting the header length from the packet length.

[0065]

In Step 10-2, whether any control code is present at the dividing position is determined based on the dividing position of the stream obtained in Step 10-1. For example, this determination is made by preparing a control code table and checking the data sequence at the dividing position. Whether any prescribed control code will be split across multiple packets is determined through the aforementioned step.

[0066]

The method for generating the data blocks, wherein prescribed control codes are competed within respective data blocks, is shown in Figure 11. Here, details of Step 8-4 are shown.

[0067]

First, in the figure, the operation begins at Step 11-1. If the result of the determination made in Step 8-3 regarding whether any prescribed control code will be split across multiple packets indicates that splitting will occur, advancement is made to Step 11-2, or advancement is made to Step 11-4 if no splitting will occur.

[0068]

In Step 11-2, the stream is divided after the applicable stream dividing position is so shifted that no control code will be split, and advancement is made to Step 11-3. For example,

when a picture header of the MPEG-2 video standard corresponds to this control code, the stream dividing position is moved a position immediately before the picture header when dividing the stream to avoid the control code from being split.

[0069]

In Step 11-3, stuffing data are inserted into the segment stream obtained in Step 11-2, and advancement is made to Step 11-5. For example, when carrying out packetization in conformity with the MPEG-2 system standard, the stuffing data are inserted before or after the segment stream. The length of the stuffing data can be obtained by subtracting the length of the segment stream obtained in Step 11-2 from the necessary block length. The necessary block length is obtained using the aforementioned prescribed packetization method. For example, when a packetization method involving a fixed packet length is used as the prescribed packetization method, the necessary block length is obtained by subtracting the header length from the packet length. The stuffing data do not have to be inserted if not needed. The stuffing data are already described above.

[0070]

In Step 11-4, the stream is divided according to the aforementioned prescribed packetization method, and advancement is made to Step 11-5. For example, when a packetization method involving a fixed packet length is used as the prescribed packetization method, the stream is divided into the length obtained by subtracting the header length from the packet length.

[0071]

In Step 11-5, the data obtained in Step 11-3 or Step 11-4 are used as data blocks. The data blocks are generated through the aforementioned steps such that no prescribed control code will be split across multiple packets.

[0072]

The method for determining whether a data sequence comprising data in the stream and a part of the added header becomes a data sequence identical to that of any prescribed control code is shown in Figure 12. Here, details of Step 9-3 are shown.

[0073]

First, in the figure, the operation begins at Step 12-1. The positions where the stream should be are obtained based on the aforementioned prescribed packetization method, and advancement is made to Step 12-2. This step is identical to Step 10-1.

[0074]

In Step 12-2, after the data located before and after the stream dividing positions obtained in Step 12-1 and the data in the headers to be added are compared, a table containing data sequences that have the same length as that of a control code out of the data sequences generated by combining them is generated, and advancement is made to Step 12-3. When multiple control codes of different lengths are involved, the table is generated to accommodate said lengths. For example, when the control code is 4 bytes long, the stream before a dividing position ends with 0x000001, and the packet to be added begins with 0x000001, 0x00000100, 0x00010000, and 0x01000001 are added to the table.

[0075]

In Step 12-3, the data sequence table obtained in Step 12-2 and prescribed control data are compared to determine whether the data sequences are identical. For example, this determination is made by preparing a control code table and comparing it with the table obtained in Step 12-2. When the data sequence table is the one shown in the example given above, assuming that picture start code 0x00000100 is contained in the control data table, a determination is made that an identical data sequence is present. The determination regarding whether the data sequence comprising the data in the stream and the part of the header added becomes a data sequence identical to any prescribed control code is made through the aforementioned steps.

[0076]

The method for generating the data blocks containing no data sequence identical to that of any control code is shown in Figure 13. Here, details of Step 9-4 are shown.

[0077]

First, in the figure, the operation begins at Step 13-1. If the result of the determination made in aforementioned Step 9-3 regarding whether the data sequence comprising the data in the stream and the part of the header added becomes a data sequence identical to that of a prescribed control code indicates that an identical data sequence will be generated, advancement is made to Step 13-2; advancement is made to Step 13-4 if no identical data sequence will be generated.

[0078]

In Step 13-2, the stream is divided after the applicable stream dividing position is so shifted that no identical data sequence will be generated, and advancement is made to Step 13-3. For example, when a stream in conformity with the MPEG-2 video standard is packetized in accordance with the MPEG-2 system standard, if specific data sequence 0x000001 is present at the end of a data block, it is combined with starting data sequence 0x000001E0 in the header of the next packet. As a result, picture start code 0x00000100 of the MPEG-2 video standard that is supposed to be detected only within a data block, appears at the packet boundary. In such case, the problem can be avoided by dividing the stream after the applicable dividing position is shifted to a position immediately before the specific data sequence when generating data blocks.

[0079]

In Step 13-3, stuffing data are inserted into the segment stream obtained in Step 13-2, and advancement is made to Step 13-5. For example, when carrying out packetization in conformity with the MPEG-2 system standard, the stuffing data are inserted before or after the segment stream. The length of the stuffing data can be obtained by subtracting the length of the segment stream obtained in Step 13-2 from the necessary block length. The necessary block length is obtained using the aforementioned prescribed packetization method. For example, when a packetization method involving a fixed packet length is used as the prescribed packetization method, the necessary block length is obtained by subtracting the header length from the packet length. The stuffing data do not have to be inserted if not needed. The stuffing data are already described above. This step is identical to Step 11-3.

[0080]

In Step 13-4, the stream is divided according to the aforementioned prescribed packetization method, and advancement is made to Step 13-5. For example, when a packetization method involving a fixed packet length is used as the prescribed packetization method, the stream is divided into the length obtained by subtracting the header length from the packet length. This step is identical to Step 11-4.

[0081]

In Step 13-5, the data obtained in Step 13-3 or Step 13-4 are used as data blocks. This step is identical to Step 11-5. The data blocks are generated through the aforementioned steps such that no data sequence identical to any prescribed control code will be generated.

[0082]

Next, the aforementioned prescribed control code will be explained.

[0083]

It will be explained using the example configuration of the packet and the control code shown in Figure 6. Packet 6-1 comprises header 6-2 and data block 6-3. The data block is configured with a stream. Control code 6-4 is present inside the stream. The control code comprises start code 6-5 that indicates where information begins in the stream, or an end code that indicates sync data and where information ends in the stream, and accompanying data sequence 6-6. For example, in the case of the MPEG-2 standard, a sequence header, a picture header, an audio access unit header, an audio frame, and audio sampling data are treated as control codes.

[0084]

The sequence header begins with sequence start code 0x000001B3 and has an accompanying data sequence indicating bit rate information, for example. The picture header begins with picture start code 0x00000100 and has an accompanying data sequence indicating a picture type, for example. The audio access unit header begins with sync data 0xFFF and has an accompanying data sequence indicating a layer, for example. Those accompanying data may be omitted. The length of the control code may be matched with the data length to be detected by the unit of a packet. Control codes of the MPEG-2 standard are described in ISO/IEC 13818 standard.

[0085]

A configuration diagram of an application example of the present invention is shown in Figure 14; whereby, a method in which a stream is divided into multiple data blocks, and headers are added to the respective data blocks to generate packets using data packetization device 14-1 will be explained.

[0086]

In the figure, first, a stream is input to dividing position detection part 14-2. The dividing position detection part outputs stream dividing positions that are used for dividing the stream based on a prescribed packetization method. Here, a method in which a fixed data block length or a fixed packet length is used for packetization, a method in which a stream is divided based on a prescribed timer interval for packetization, or a method that combines them are feasible as the prescribed packetization method. For example, when a packetization method involving a fixed

packet length is used as the prescribed packetization method, the distance of the dividing position from the beginning position of the stream is obtained by subtracting the header length from the packet length.

[0087]

Next, the aforementioned dividing positions and the stream are input to determination part 14-3. The determination part determines whether any control code is present at the dividing positions based on the dividing positions of the stream input and outputs a determination result. For example, this determination is made by preparing a control code table and checking the data sequence at the dividing position.

[0088]

Next, the aforementioned determination result and the stream are input to dividing position configuration part 14-4. The dividing position configuration part configures the stream dividing positions such that prescribed control codes will be completed within data blocks. If the aforementioned determination result indicates that no control code will be split, a means similar to dividing position detection part 14-2 outputs stream dividing positions based on the prescribed packetization method; it outputs the dividing positions after they are so shifted that no control code will be split if splitting is indicated. For example, when a picture header of the MPEG-2 video standard corresponds to this control code, the stream dividing position is moved to a position immediately before the picture header when dividing the stream to avoid the control code from being split.

[0089]

Next, the aforementioned dividing positions and the stream are input to stream dividing part 14-5. The stream dividing part divides the stream input based on the dividing positions input and outputs segment streams.

[0090]

Next, the aforementioned segment streams are input to stuffing data insertion part 14-6. The stuffing data insertion part adds stuffing data to the applicable segment stream and outputs data blocks. For example, when carrying out packetization in conformity with the MPEG-2 system standard, the stuffing data are inserted before or after the segment stream. The length of the stuffing data can be obtained by subtracting the length of the segment stream from the necessary block length. The necessary block length is obtained using the aforementioned prescribed packetization method. For example, when a packetization method involving a fixed

packet length is used as the prescribed packetization method, the necessary block length is obtained by subtracting the header length from the packet length. The stuffing data do not have to be inserted if not needed. The stuffing data are already described above.

[0091]

Next, the aforementioned data blocks are input to packet generation part 14-7. The packet generation part adds headers to the respective data blocks to generate packets and outputs the packets. The packet and the header are already described above. The data blocks, wherein the prescribed control codes contained in the stream are completed within the data blocks, are generated through the aforementioned steps.

[0092]

A configuration diagram of another application example of the present invention shown in Figure 15; whereby, a method in which a stream is divided into multiple data blocks, and headers are added to the respective data blocks to generate packets using data packetization device 15-1 will be explained.

[0093]

In the figure, first, a stream is input to dividing position detection part 15-2. The dividing position detection part outputs stream dividing positions that are used for dividing the stream based on a prescribed packetization method. For example, when a packetization method involving a fixed packet length is used as the prescribed packetization method, the distance of the dividing position from the beginning position of the stream is obtained by subtracting the header length from the packet length. This dividing position detection part 15-2 is a means similar to aforementioned dividing position detection part 14-2.

[0094]

Next, the aforementioned dividing positions and the stream are input to determination part 15-3. The determination part outputs a determination result regarding whether any data sequence comprising partial data of the stream and a part of a header added will become identical to that of any prescribed control code when the stream is packetized based on the prescribed packetization method. Here, after the data located before and after the stream dividing positions and the data in the headers to be added are compared, a table containing data sequences that have the same length as that of a control code out of the data sequences generated by combining them is generated, and the data sequences are checked against the control code table to make the determination.

[0095]

When multiple control codes of different lengths are involved, the table is generated to accommodate said lengths. For example, when a stream in conformity with the MPEG-2 video standard is packetized in accordance with the MPEG-2 system standard, assuming that the control code is 4-byte long, the stream before a dividing position ends with 0x000001, and the packet to be added begins with 0x000001, such data sequences as 0x00000100, 0x00010000, and 0x01000001 are included when generating the table, and it is compared with the control data [sic; code] table. Assuming that picture start code 0x00000100 is included in the control data [sic; code] table, a determination is made that an identical data sequence is present in this case.

[0096]

Next, the aforementioned determination result and the stream are input to dividing position configuration part 15-4. The dividing position configuration part outputs such positions that no data sequence comprising data in the stream and a part of a header added becomes a data sequence identical to any prescribed control code as stream dividing positions. If the aforementioned determination result indicates that no data sequence identical to that of any control code is present, a means similar to dividing position detection part 15-2 outputs stream dividing positions based on the prescribed packetization method; it outputs the dividing positions after they are so shifted that no control code will be split if splitting is indicated.

[0097]

For example, when a stream in conformity with the MPEG-2 video standard is packetized in accordance with the MPEG-2 system standard, assuming that specific data sequence 0x000001 is present at the end of a stream located before a dividing position, it is combined with starting data sequence 0x000001E0 in the header of the next packet. As a result, picture start code 0x00000100 of the MPEG-2 video standard that is supposed to be detected only within a data block, appears at the packet boundary. In such case, the problem can be avoided by shifting the dividing position to a position immediately before the specific data sequence.

[0098]

Next, the aforementioned dividing positions and the stream are input to stream dividing part 15-5. The stream dividing part divides the stream input based on the dividing positions input and outputs segment streams. This stream dividing part 15-5 is a means similar to aforementioned stream dividing part 14-5.

[0099]

Next, the aforementioned segment streams are input to stuffing data insertion part 15-6. The stuffing data insertion part adds stuffing data to the applicable segment stream and outputs data blocks. For example, when carrying out packetization in conformity with the MPEG-2 system standard, the stuffing data are inserted before or after the segment stream.

[0100]

The length of the stuffing data can be obtained by subtracting the length of the segment stream from the necessary block length. The necessary block length is obtained using the aforementioned prescribed packetization method. For example, when a packetization method involving a fixed packet length is used as the prescribed packetization method, the necessary block length is obtained by subtracting the header length from the packet length. The stuffing data do not have to be inserted if not needed. The stuffing data are already described above. This stuffing data insertion part 15-6 is a means similar to aforementioned stuffing data insertion part 14-6.

[0101]

Next, the aforementioned data blocks are input to packet generation part 15-7. The packet generation part adds headers to the respective data blocks to generate packets and outputs the packets. The packet and the header are already described above. This packet generation part 15-7 is a means similar to aforementioned packet generation part 14-7. The data blocks, wherein no data sequence comprising data in the stream and a part of a header added becomes a data sequence identical to any prescribed control code, are generated through the aforementioned steps.

[0102]

Furthermore, although the MPEG-2 standard was exemplified in the aforementioned application examples, it does not means that the present invention is restricted to said examples. The present invention can be applied to other encoding processing in that it is plausible that the same problems occur not only with the MPEG-2 standard but also during data encoding processing involving packetization and multiplexing in general. For example, the MPEG-4 standard may be mentioned. In addition, the packetized data generated using the present invention can be transmitted using a communication means.

[0103]

Effect of the invention

With the present invention, occurrence of a control code split across multiple packets and a pseudo-code can be prevented, a packetized stream from which information can be detected by inspecting individual packets can be generated, and encoded data sequences that can be analyzed easily can be obtained. As a result, there is no need for disassembling packets to detect control codes, so the decoding and the analyzer can be simplified to reduce the scale of the circuit.

Brief description of the figures

Figure 1 is a diagram for explaining an application example of packetized data used in the present invention.

Figure 2 is a diagram for explaining packetized data of a conventional example.

Figure 3 is a diagram for explaining packetized data of another conventional example.

Figure 4 is a diagram for explaining another application example of packetized data used in the present invention.

Figure 5 is a diagram for explaining a common packet configuration.

Figure 6 is a diagram for explaining an example configuration of a packet and a control code.

Figure 7 is a block diagram showing an example configuration of a computer system used in the present invention.

Figure 8 is a flow chart showing an example data packetization method used in the present invention.

Figure 9 is a flow chart showing an example data packetization method used in the present invention.

Figure 10 is a flow chart showing an example data packetization method used in the present invention.

Figure 11 is a flow chart showing an example data packetization method used in the present invention.

Figure 12 is a flow chart showing an example data packetization method used in the present invention.

Figure 13 is a flow chart showing an example data packetization method used in the present invention.

Figure 14 is a block diagram of a data packetization device of an application example of the present invention.

Figure 15 is a block diagram of a data packetization device of another application example of the present invention.

Explanation of symbols

14-1 … data packetization device; 14-2 … dividing position detection part; 14-3 … determination part; 14-4 … dividing position configuration part; 14-5 … stream dividing part; 14-6 … stuffing data insertion part; 14-7 … packet generation part.

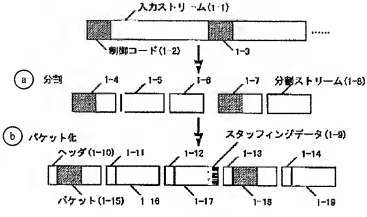

Figure 1

Key: a Division
b Packetization
1-1 Input stream
1-2 Control code
1-8 Segment stream
1-9 Stuffing data
1-10 Header
1-15 Packet

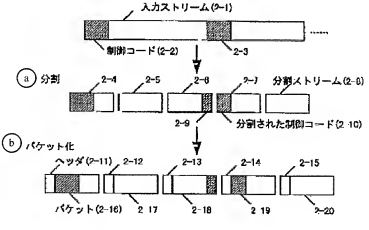

Figure 2

Key: a Division
b Packetization
2-1 Input stream
2-2 Control code
2-8 Segment stream
2-10 Split control code
2-11 Header
2-16 Packet

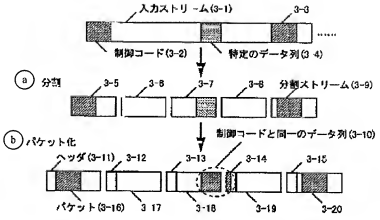

Figure 3

Key: a Division
b Packetization
3-1 Input stream
3-2 Control code
3-4 Specific data sequence
3-9 Segment stream
3-10 Data sequence identical to that of control code
3-11 Header
3-16 Packet

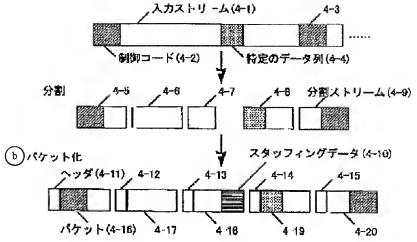

Figure 4

Key: a Division
b Packetization
4-1 Input stream
4-2 Control code
4-4 Specific data sequence
4-9 Segment stream
4-10 Stuffing data
4-11 Header
4-16 Packet

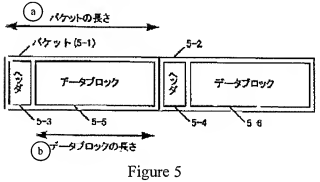

Figure 5

Key: a Length of packet
b Length of data block
5-1, 5-2 Packet
5-3, 5-4 Header
5-5, 5-6 Data block

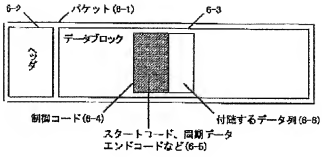

Figure 6

Key: 6-1 Packet
6-2 Header
6-3 Data block
6-4 Control code
6-5 Start code, sync data end code, etc.
6-6 Accompanying data sequence

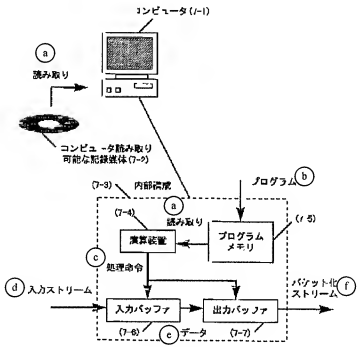

Figure 7

Key: a Read
b Program
c Processing command
d Input stream
e Data

f Packetized stream
7-1 Computer
7-2 Computer-readable recording medium
7-3 Internal configuration
7-4 Arithmetic unit
7-5 Program memory
7-6 Input buffer
7-7 Output buffer

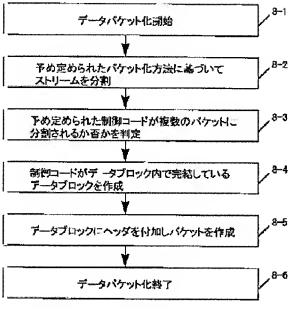

Figure 8

Key: 8-1 Start packetization
8-2 Divide the stream based on the prescribed packetization method
8-3 Determine whether any prescribed control code will be split across multiple packets
8-4 Generate data blocks in which control codes are completed within the data blocks
8-5 Generate packets by adding headers to the data blocks
8-6 End packetization

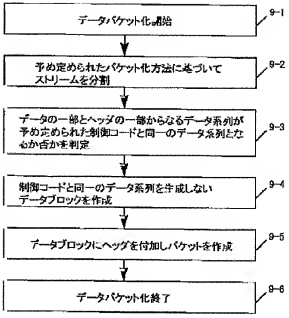

Figure 9

Key: 9-1 Start packetization
9-2 Divide the stream based on the prescribed packetization method
9-3 Determine whether any data sequence comprising partial data and a part of header will become a data sequence identical to that of any prescribed control code
9-4 Generate data blocks that contain no data sequence identical to that of any control code
9-5 Generate packets by adding headers to the data blocks
9-6 End packetization

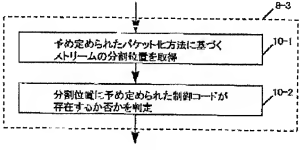

Figure 10

Key: 10-1 Obtain stream dividing positions based on the prescribed packetization method
10-2 Determine whether a prescribed control code is present at any dividing position

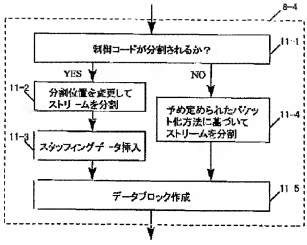

Figure 11

Key: 11-1 Any control code is split?
11-2 Divide the stream after the applicable dividing position is shifted
11-3 Insert stuffing data
11-4 Divide the stream based on the prescribed packetization method
11-5 Generate data blocks

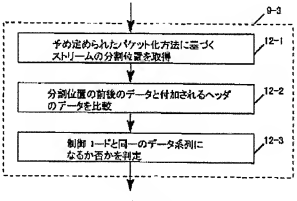

Figure 12

Key: 12-1 Obtain stream dividing positions based on the prescribed packetization method
12-2 Compare the data located before and after the stream dividing positions with the data in the headers to be added
12-3 Determine whether any data sequence identical to that of any control code will be generated

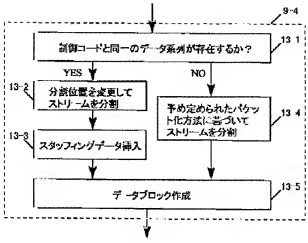

Figure 13

Key: 13-1 Any data sequence identical to that of any control code is present?
13-2 Divide the stream after the applicable dividing position is shifted
13-3 Insert stuffing data
13-4 Divide the stream based on the prescribed packetization method
13-5 Generate data blocks

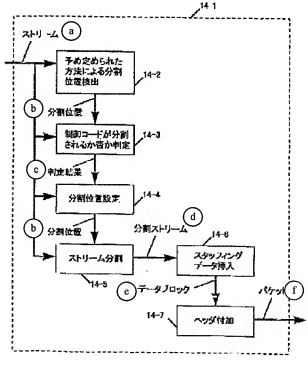

Figure 14

Key: a Stream
b Dividing positions

c Determination result
d Segment stream
e Data blocks
f Packets
14-2 Detect dividing positions using prescribed packetization method
14-3 Determine whether any control code will be split
14-4 Configure dividing positions
14-5 Division of the stream
14-6 Insert stuffing data
14-7 Addition of headers

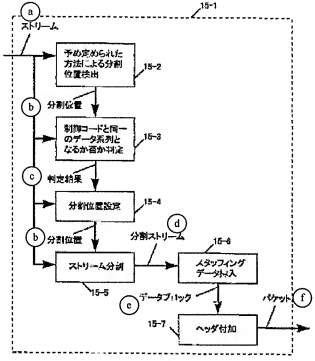

Figure 15

Key: a Stream
b Dividing positions
c Determination result
d Segment stream
e Data blocks
f Packets
15-2 Detect dividing positions using prescribed packetization method
15-3 Determine whether any data sequence identical to that of any control code will be generated
15-4 Configure dividing positions
15-5 Divide the stream
15-6 Insert stuffing data

15-7 Addition headers

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